MAINTAINING THE NATIVE PLANT COMMUNITY DURING LONGLEAF PINE (*Pinus palustris* Mill.) ESTABLISHMENT

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SUMMARY

Site preparation treatments were evaluated to determine which were useful for establishing longleaf pine seedlings without excessive long-term damage to the native understory. Hexazinone treatments of 1.1 to 2.2 kg/ha were sufficient to reduce woody competition and allow the successful establishment of longleaf seedlings using hand planting of containerized stock. Hexazinone at rates of 2.2 kg/ha followed by strip scalping and machine planting resulted in slightly higher seedling survival rates. Although there was some initial exposure of soil and a decline in grass cover, the understory soon recovered. Thus, this treatment can be used to re-establish longleaf without undue damage to the understory.

INTRODUCTION

Longleaf pine is the key tree species in a complex of fire-dependent ecosystems long native to the southeastern United States (1). It once occupied perhaps as much as 25 million hectares, stretching from southeastern Virginia south to central Florida and west into eastern Texas (2). These forests have been intensively exploited since colonial times with little regard for regeneration. Currently only 1.3 million hectares of longleaf pine forest remain. The continuing reduction of this important forest type carries with it a risk to the myriad of life forms characteristic of and largely dependent on longleaf pine ecosystems. The diversity of ground cover plants per unit area places longleaf pine ecosystems among the most species-rich plant communities outside the Tropics. Extreme habitat reduction is the main cause for the precarious state of at least 191 taxa of vascular plants (3).

The need to re-establish longleaf on former sites is now widely recognized. It is believed that native understory grasses, especially wiregrass (*Aristida stricta*) and woody shrubs can be strong competitors during the regeneration phase. Numerous mechanical site preparation systems have been used to reduce competition prior to planting longleaf seedlings. These were quite effective in increasing seedling survival but they also resulted in significant reductions in the native understory grasses. Two passes with a double drum chopper, for example, will nearly eliminate wiregrass from dry sites (4) and will severely reduce it on wet flatwoods sites (5). All soil-disturbing site preparation methods reduce wiregrass cover, and it does not seem to recover even after long periods of time (6). Using selective herbicides for site preparation appears to cause less long-term damage to the understory (7). The purpose of this study was to evaluate site preparation treatments to determine if alternative techniques could be found which were successful in both re-establishing longleaf and maintaining the native understory plant community.

Thus, it is possible to re-establish longleaf without drastically changing the understory community. Managers who want treatments with low risk to the understory and very little visible evidence of impact can utilize low rate hexazinone treatments and hand planting. Those mangers who wish to utilize machine planting can do so by using a combination of hexazinone and planting in scalped strips. Although this treatment exposes some bare soil and causes some disturbance of the understory, the effect is only temporary as the understory will recover rapidly.

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METHODS

Site preparation treatments were applied at three dry sandhills sites on the Ocala National Forest in central Florida. These sites were former longleaf stands with a dense cover of scrub oaks and a good intact understory of wiregrass and associated species. Treatments consisting of liquid hexazinone at 1.1 kg/ha a.i., liquid hexazinone at 2.2 kg/ha, granular hexazinone at 1.1 kg/ha, and an untreated control were randomly assigned to 0.25-ha plots at each site. The liquid hexazinone was applied on a 2-by-2m grid with spot guns and the granular herbicide was broadcast. Treatments were applied in May and all plots were hand planted with containerized longleaf seedlings the following winter. An operational treatment consisting of liquid hexazinone at 2.2 kg/ha applied by spot gun and machine planting of containerized longleaf in a scalped strip about 1-m wide was used to plant the remainder of each site.

Prior to treatment, ten 15-m transects were established in each of the operational portions of the sites. Cover by species was collected from these transects before site preparation treatments. All transects were surveyed again at the end of the first, second, and third growing seasons since site preparation. Two growing seasons after planting, longleaf seedling survival was determined on 100 planting spots in a ten-by-ten configuration in the center of each treatment plot. Seedling survival and cover data for major understory species were analyzed with analyses of variance after transformation of percents.

RESULTS AND DISCUSSION

Two years after treatment seedling survival was lowest on the untreated control sites at 55 percent, while the operational treatment had the highest survival of 72 percent. Liquid hexazinone treatments were not significantly different from the operational treatment, with mean survival rates of 66 percent. The granular treatment had a lower seedling survival of 62 percent. No understory plants were selectively eliminated by the operational herbicide and strip scalping treatment. This treatment did, however, significantly reduce the cover of turkey oak (*Quercus laevis*); the primary woody competitor on the sites (Table 1). The scalping in the operational treatment exposed bare soil on 32 percent of the area. Vegetation rapidly recolonized these strips, and 3 years after treatment bare soil occurred on only a small portion of the site. This scalping also caused wiregrass, the dominate grass species, to initially decline on operational sites. It soon recovered, however, and at the end of the third growing season after treatment there was more wiregrass cover than had existed prior to treatment.

Table 1. Effect of operational hexazinone application and V-blade planting on major understory species and bare soil on sandhills sites in Florida.

	Time since treatment			
Species	Pretreatment	1 year	2 year	3 year
Aristida stricta	52 b*	36 a	49 b	58 c
Quercus laevis	11 a	0.5 b	0.5 b	1 b
Bare soil	0 a	32 c	7 b	4 b

* Row means sharing common postscripts are not significantly different ($P<0.05$)

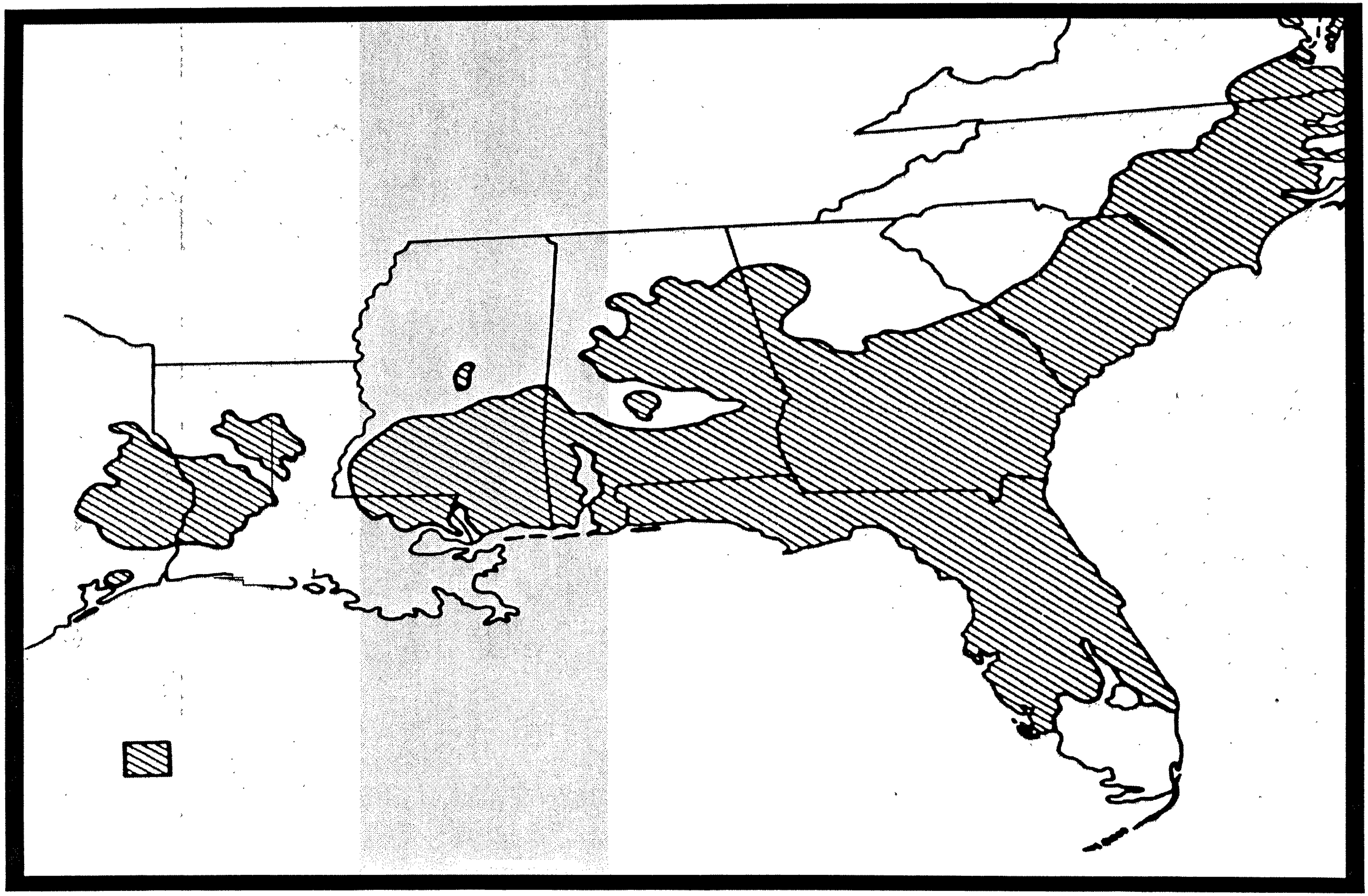

Figure 1. Presettlement range of longleaf pine - grass communities

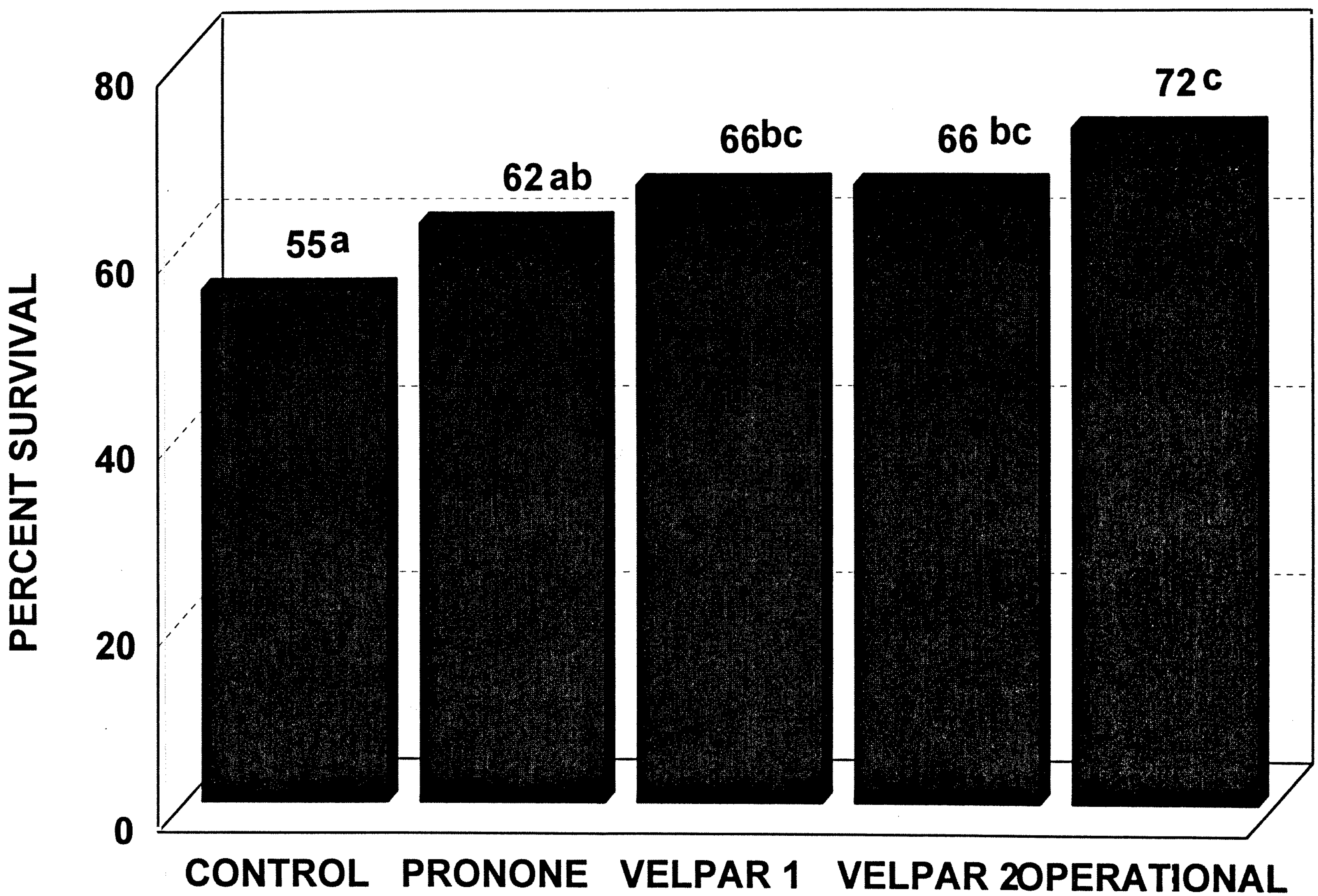

Figure 2. Effect of different vegetation control treatments on longleaf seedling survival

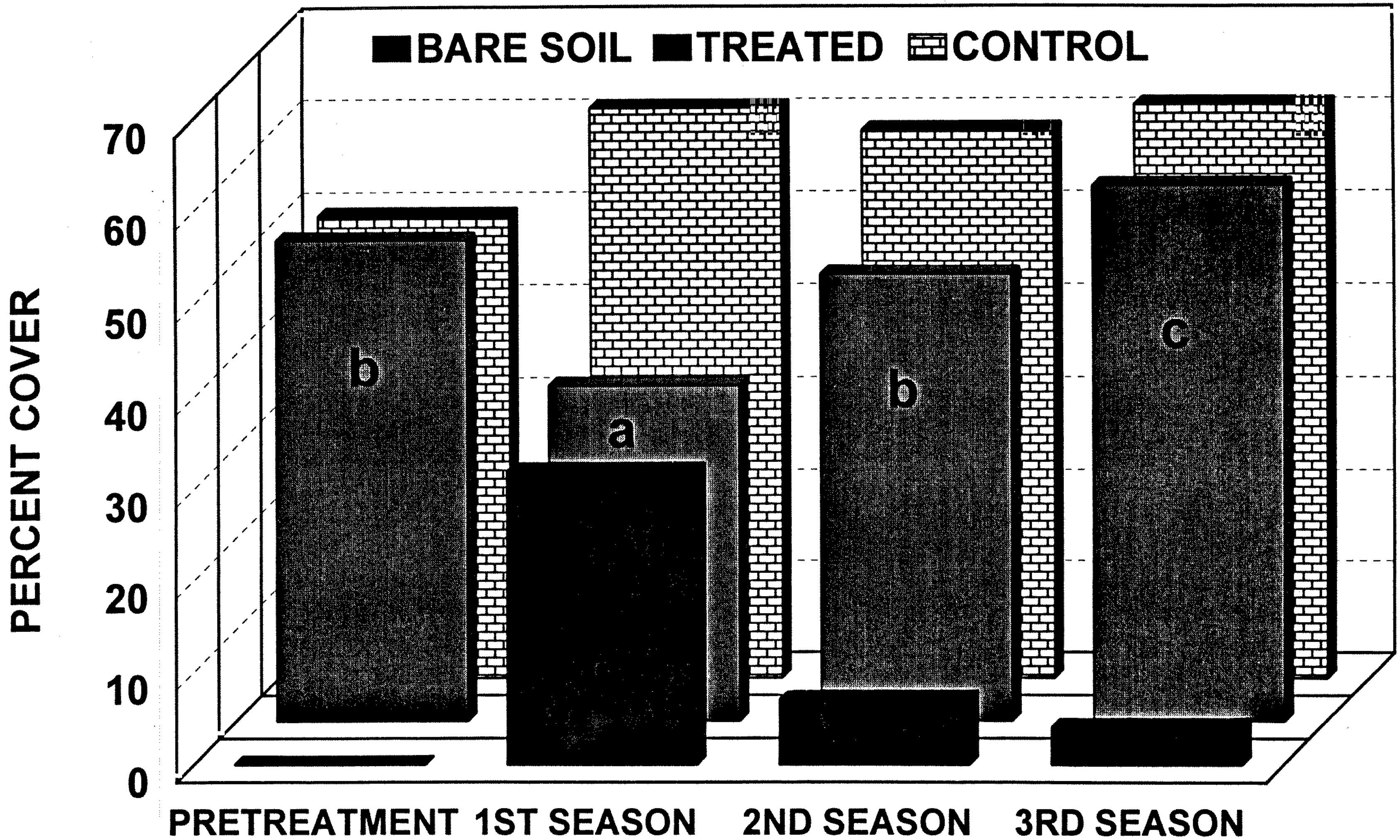

FIGURE 3. Effect of Hexazinone and V-Blade planting treatment on _Aristida stricta_ and Bare soil cover.

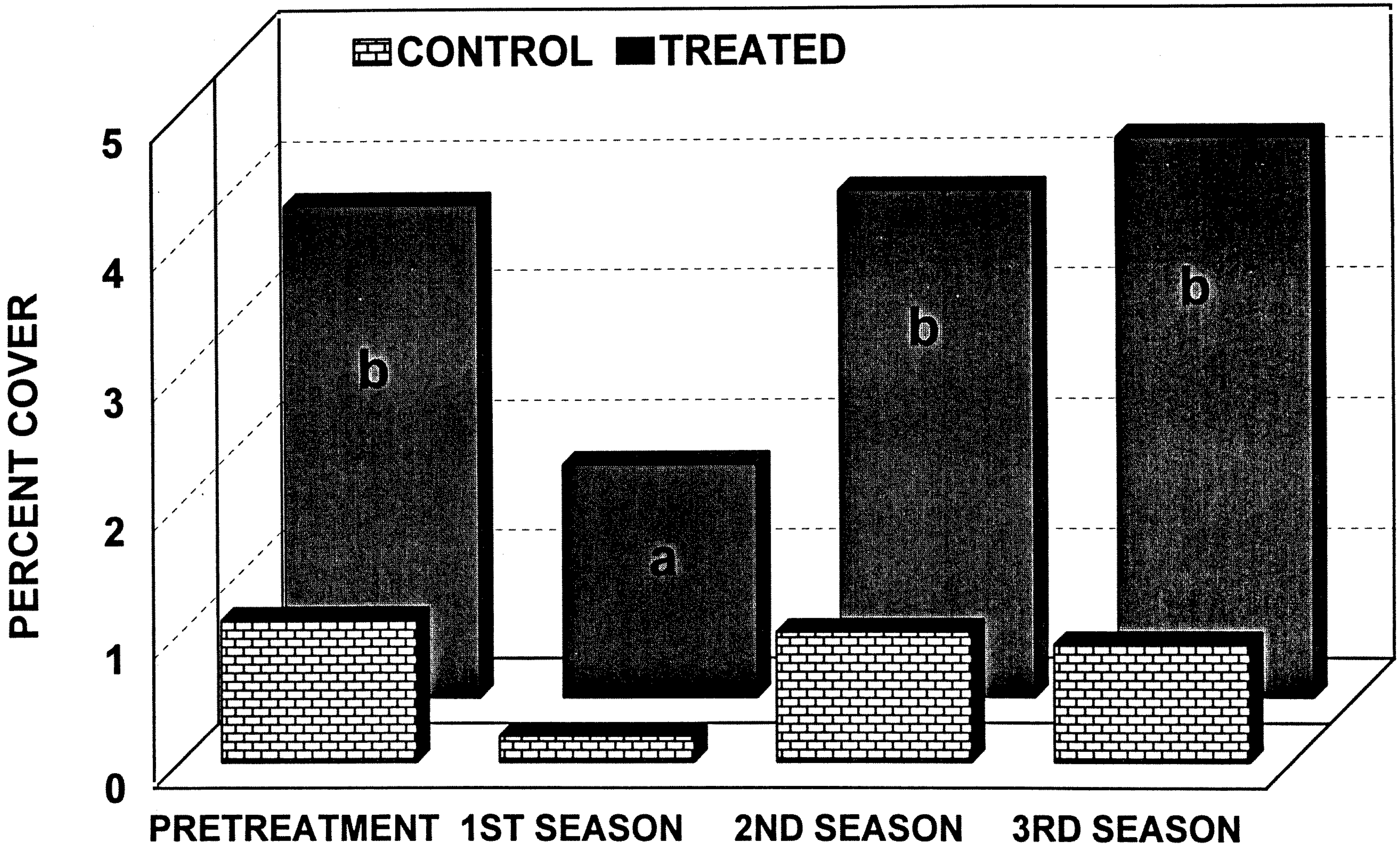

FIGURE 4. Change in _Andropogon virginicus_ cover over time on operational Hexazinone treated and control areas.

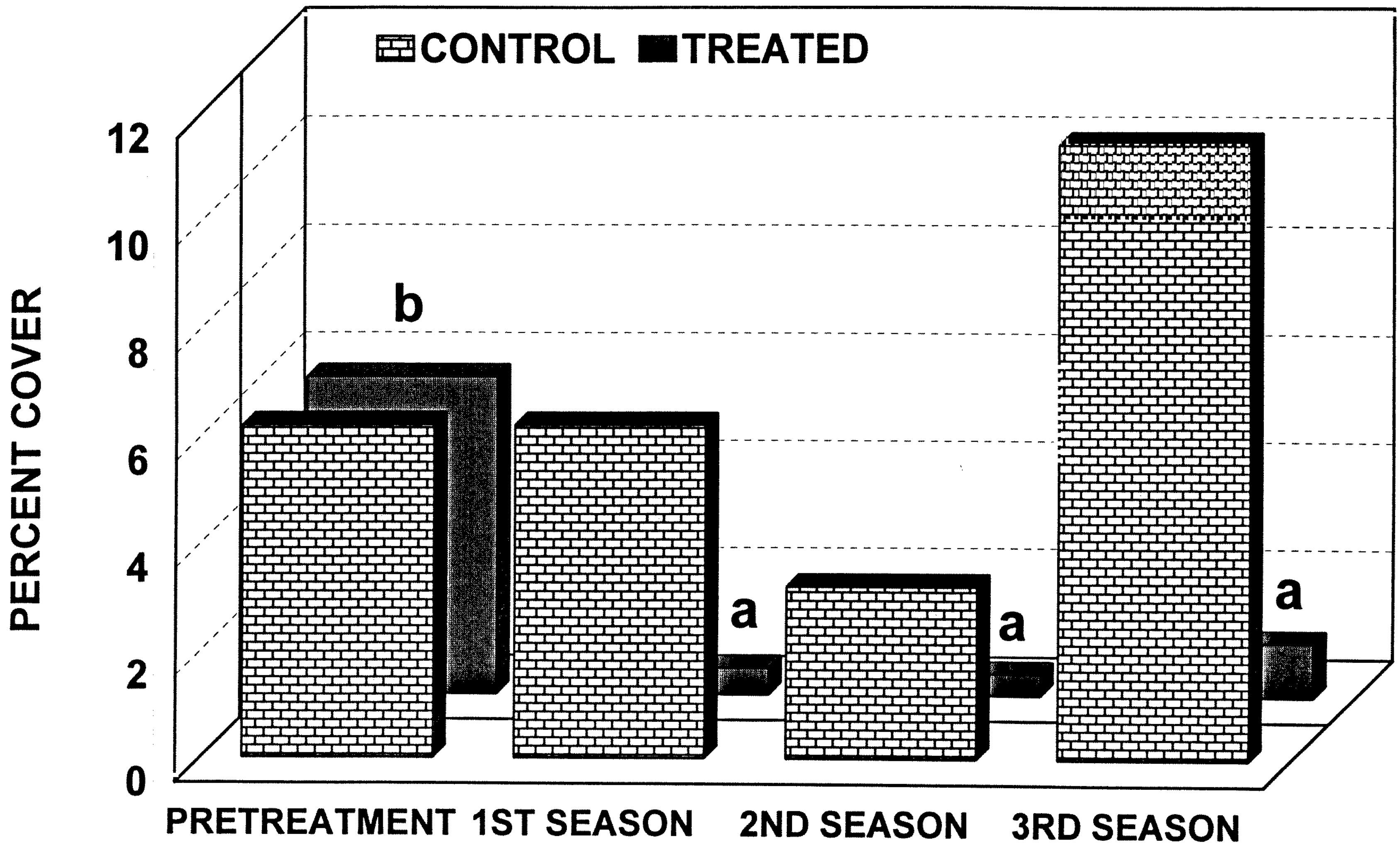

FIGURE 5. Change in *Quercus laevis* cover over time on operational Hexazinone treated and control areas.

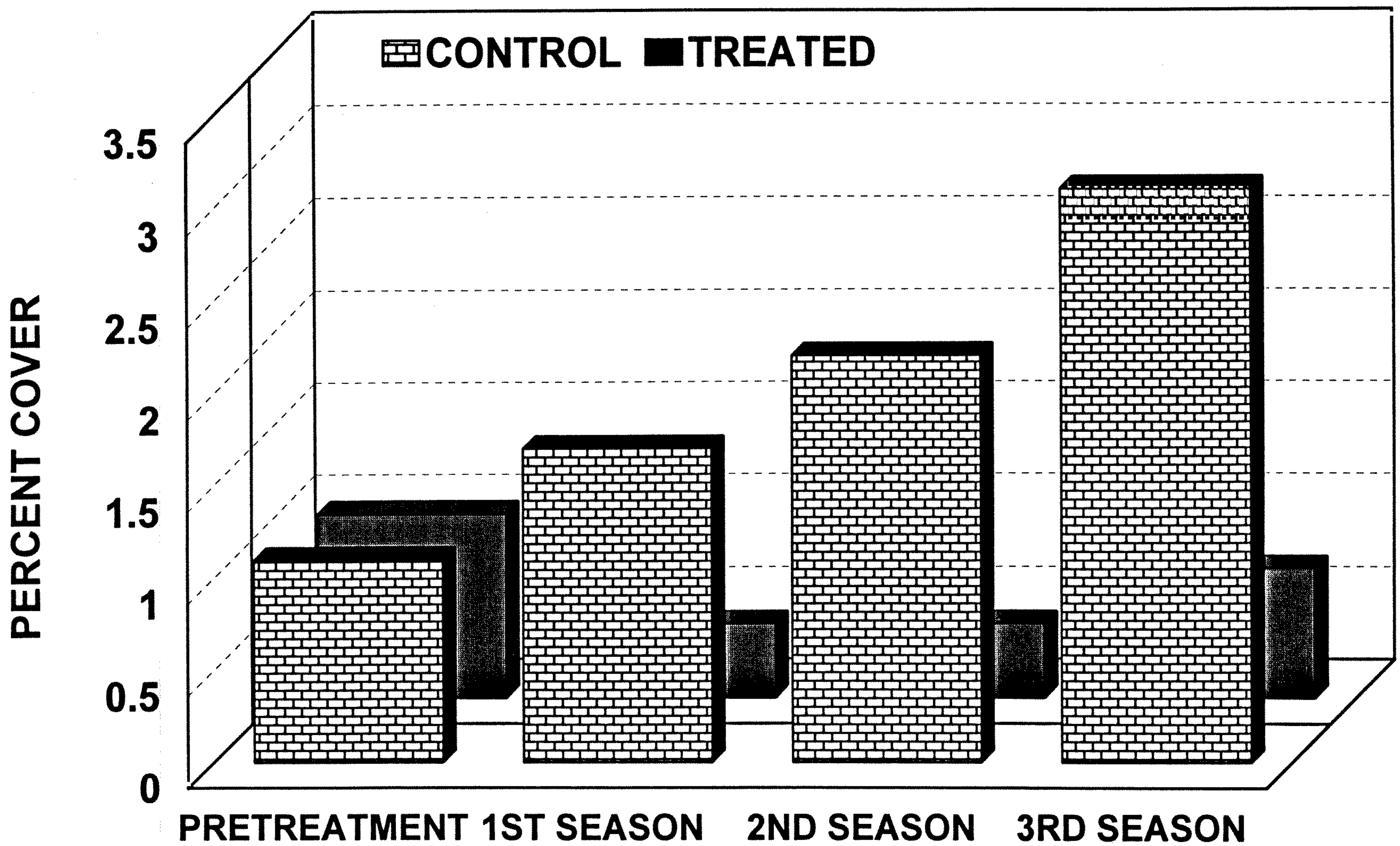

FIGURE 6. Change in <u>Licania</u> <u>michauxii</u> cover over time on operational Hexazinone treated and control areas.

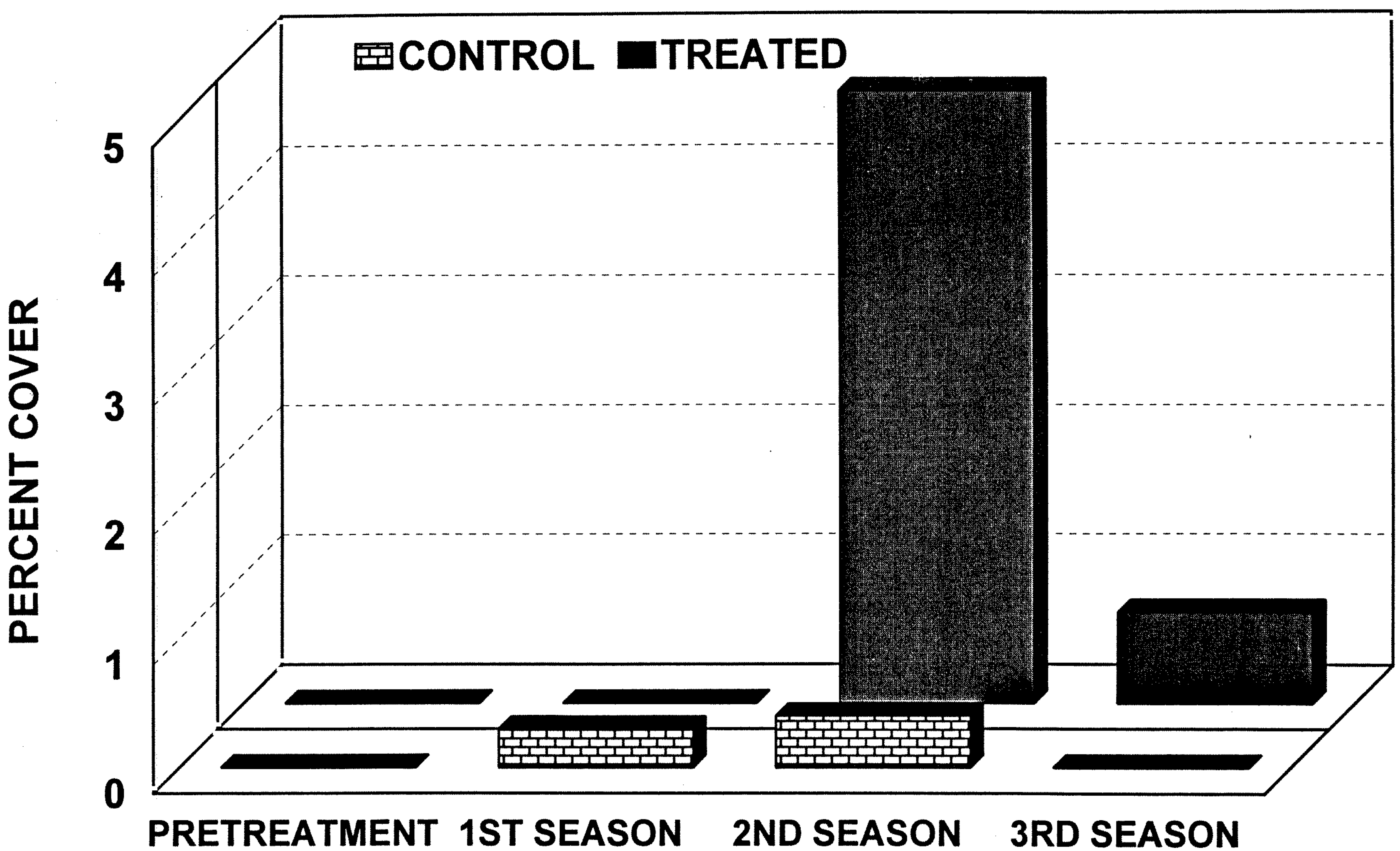

FIGURE 7. Change in _Balduina angustifolia_ cover over time on operational Hexazinone treated and control areas.

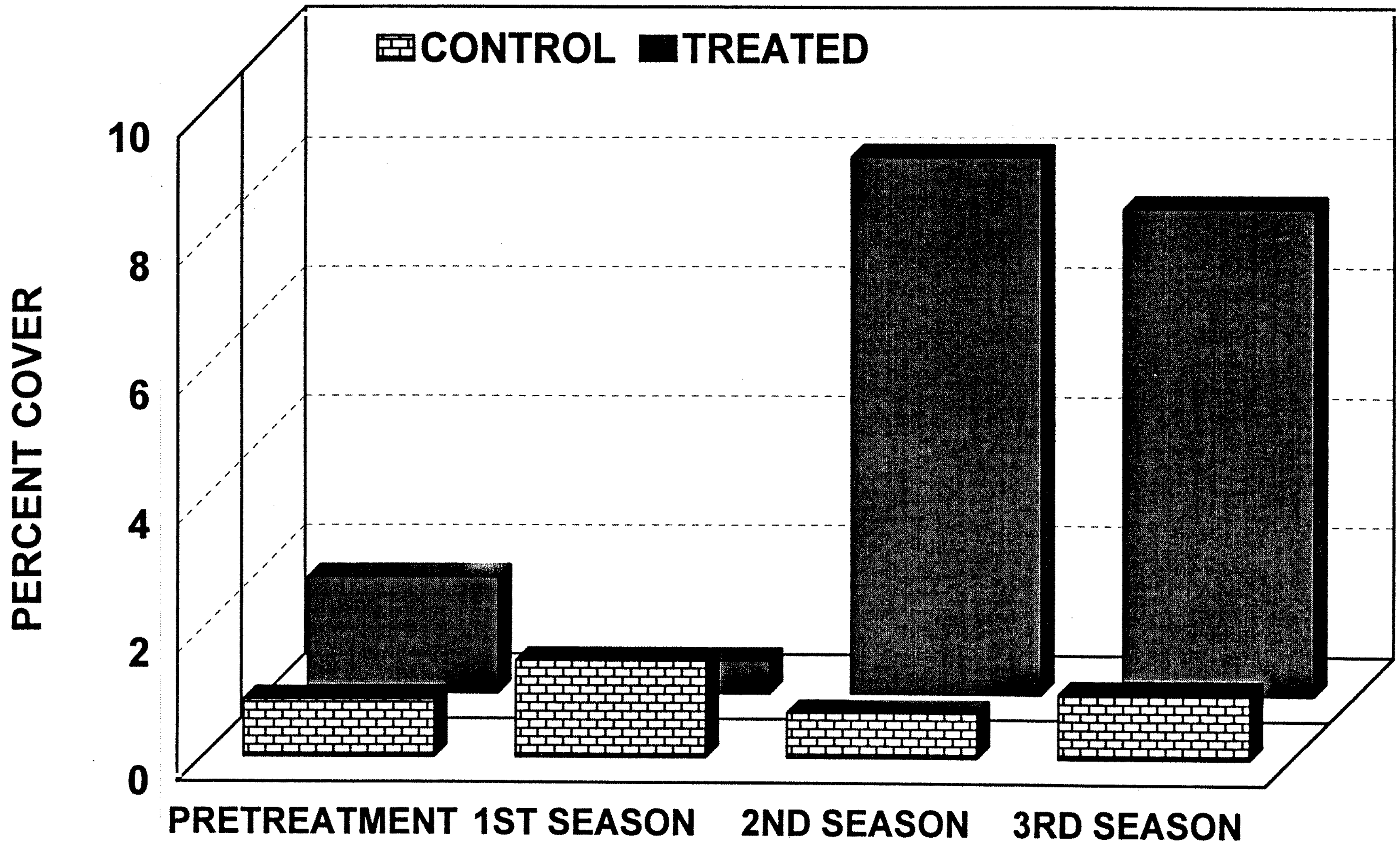

FIGURE 8. Change in <u>Eupatorium</u> <u>compositifoloum</u> cover over time on operational Hexazinone treated and control areas.

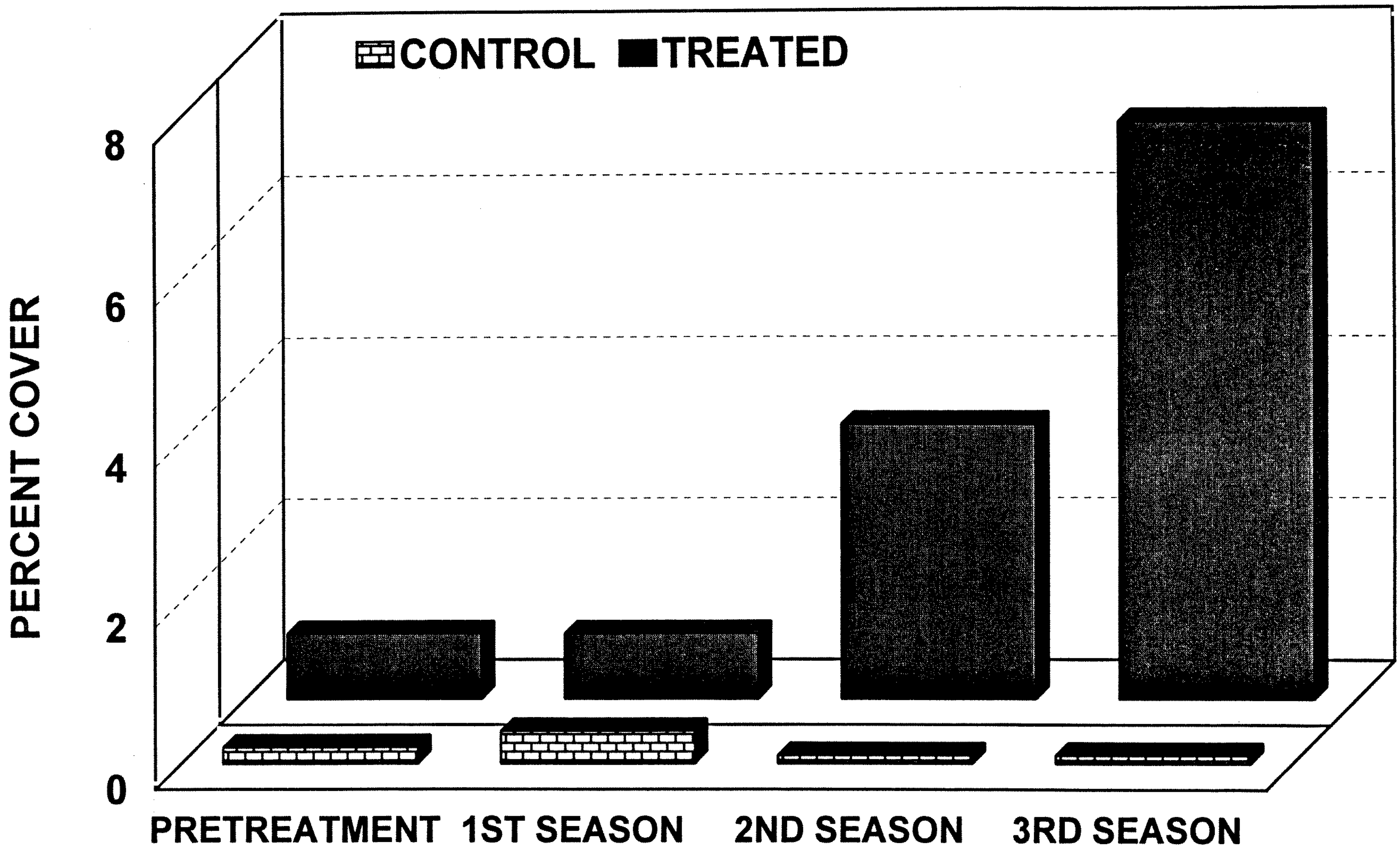

FIGURE 9. Change in Pityopsis graminifolia cover over time on treated operational Hexazinone treated and control areas.

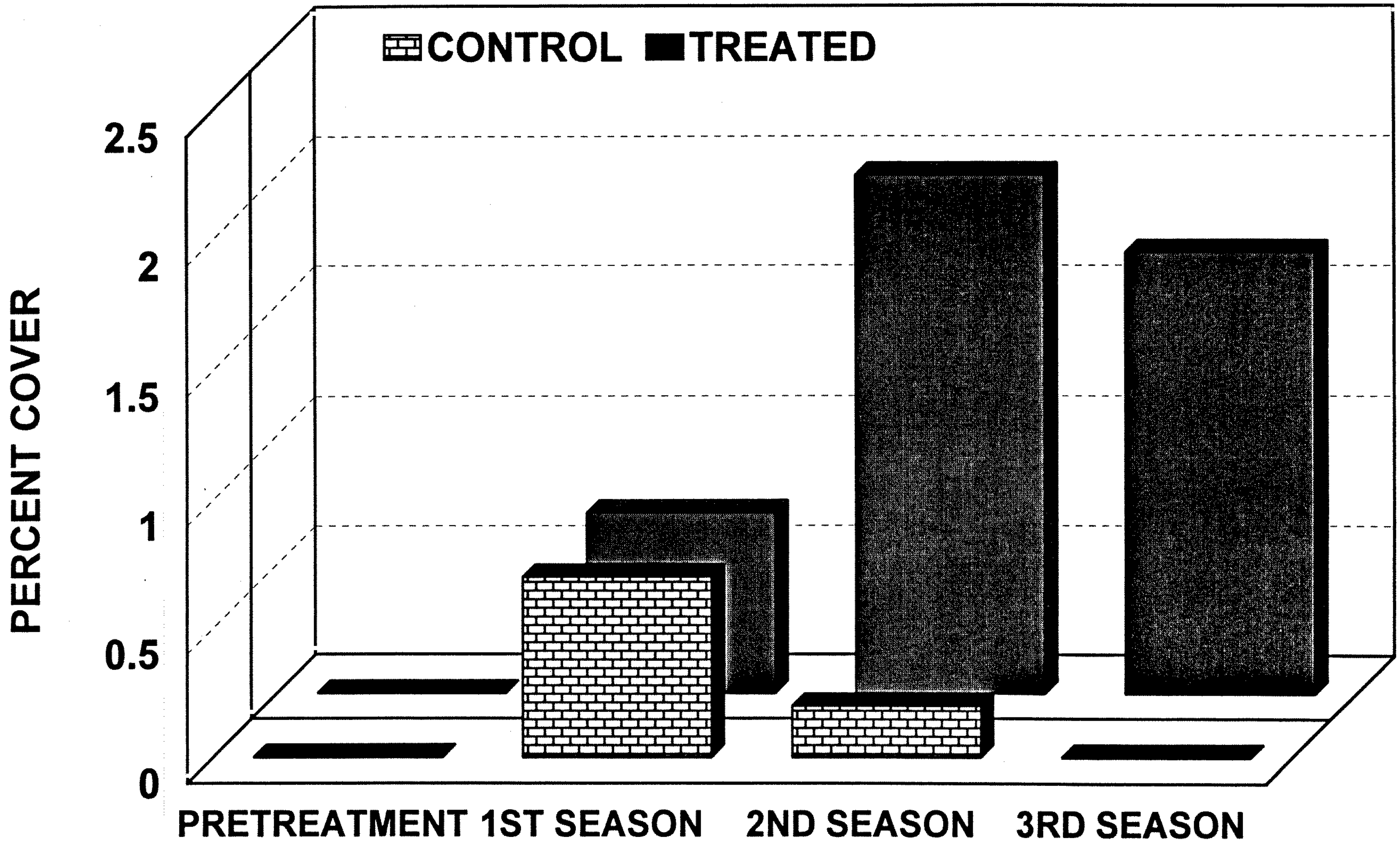

FIGURE 10. Change in _Polygonella gracilis_ cover over time on operational Hexazinone treated and control areas.

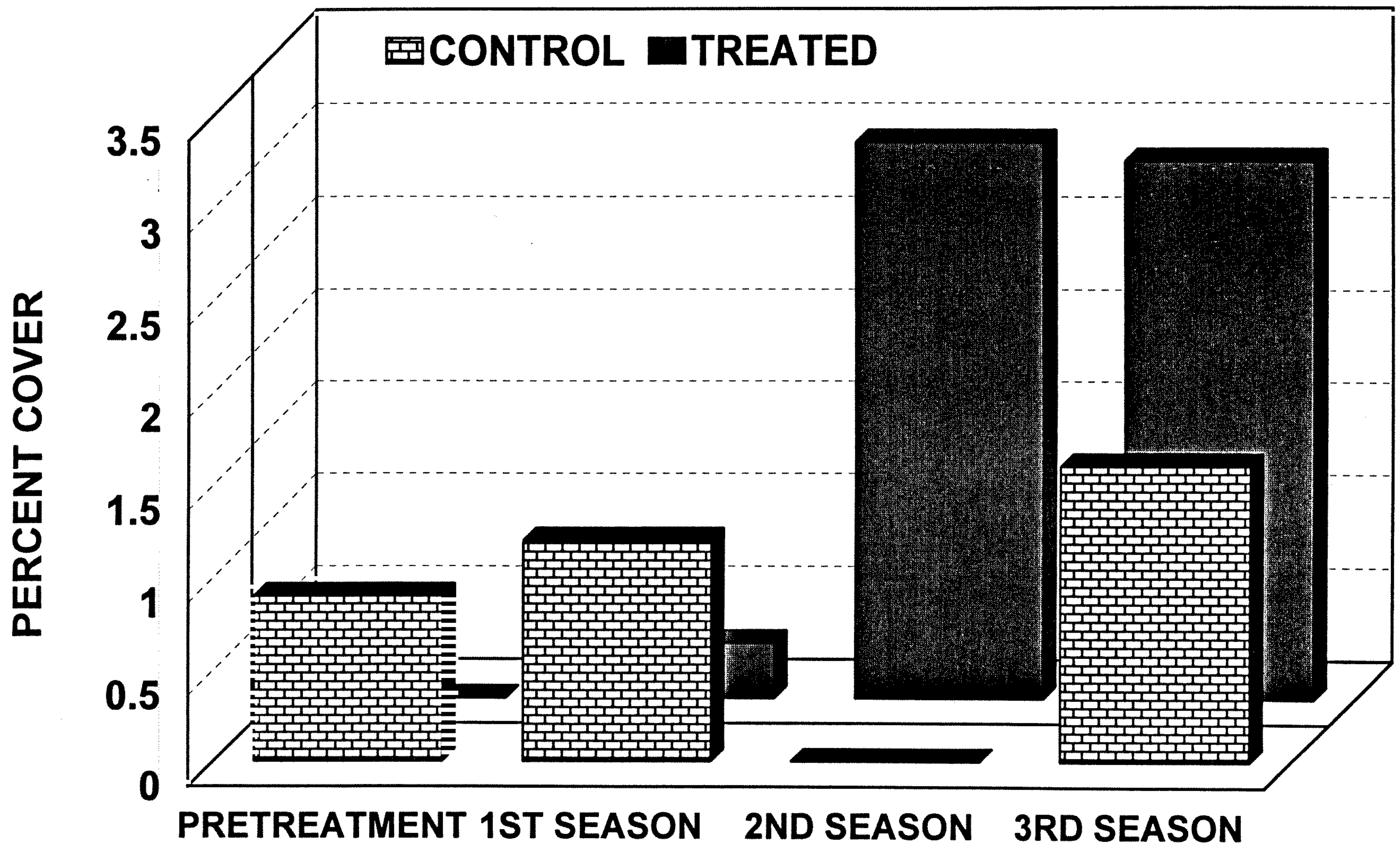

FIGURE 11. Change in <u>Sorghastrum</u> <u>secundum</u> cover over time on operational Hexazinone treated and control areas.

EFFECT OF HEXAZINONE AND V-BLADE PLANTING ON IMPORTANCE VALUE OF DOMINANT PLANT SPECIES.

Block I

PRETREATMENT		FIRST SEASON		SECOND SEASON		THIRD SEASON	
Aristida stricta	96.0	*Aristida stricta*	73.6	*Aristida stricta*	74.1	*Aristida stricta*	80.5
Quercus laevis	17.7	*Bare soil*	32.7	*Bare soil*	14.3	*Polygonella gracilis*	11.6
Andropogon virginicus	14.7	*Andropogon virginicus*	11.3	*Polygonella gracilis*	12.3	*Bare soil*	10.3
Galactia elliottii	9.1	*Pityopsis graminifolia*	9.5	*Pityopsis graminifolia*	9.1	*Pityopsis graminifolia*	9.7
Eupatorium compositifolium	8.8	*Polygonella gracilis*	8.1	*Andropogon virginicus*	6.0	*Quercus laevis*	8.6
Eriogonum tomentosum	6.7	*Quercus laevis*	7.4	*Rhynchosia reniformis*	5.6	*Eupatorium compositifolium*	7.5
Panicum spp.	5.1	*Bulbostylis warei*	5.5	*Quercus laevis*	5.2	*Agalinus spp.*	7.5

Block II

PRETREATMENT		FIRST SEASON		SECOND SEASON		THIRD SEASON	
Aristida stricta	81.2	*Bare soil*	65.0	*Aristida stricta*	48.6	*Aristida stricta*	58.7
Quercus laevis	20.4	*Aristida stricta*	59.8	*Eupatorium compositifolium*	19.2	*Eupatorium compositifolium*	17.1
Andropogon virginicus	19.1	*Andropogon virginicus*	12.4	*Triplasis spp.*	15.1	*Bare soil*	10.1
Pityopsis graminifolia	9.0	*Licania michauxii*	6.8	*Bare soil*	11.1	*Andropogon virginicus*	9.6
Lyonia ferruginea	7.5	*Bulbostylis warei*	6.1	*Sorghastrum secundum*	10.1	*Conyza canadensis*	9.6
Panicum spp.	6.5	*Aristida purpurescens*	5.9	*Pityopsis graminifolia*	9.4	*Pityopsis graminifolia*	8.9
Licania michauxii	5.4	*Pityopsis graminifolia*	4.7	*Balduina angustifolia*	8.8	*Triplasis spp*	8.8

Block III

Aristida stricta	60.3	*Bare soil*	71.5	*Aristida stricta*	33.4	*Aristida stricta*	35.5
Quercus laevis	20.2	*Aristida stricta*	43.5	*Bulbostylis warei*	18.8	*Aristida purpurascens*	24.4
Aristida purpurescens	18.1	*Andropogon virginicus*	16.2	*Eupatorium compositifolium*	14.5	*Pityopsis graminifolia*	17.1
Andropogon virginicus	16.8	*Aristida purpurascens*	14.2	*Andropogon virginicus*	13.8	*Eupatorium compositifolium*	14.4
Panicum spp.	12.1	*Eupatorium compositifolium*	8.5	*Bare soil*	13.8	*Andropogon virginicus*	13.6
Ceratiola ericoides	11.1	*Panicum spp.*	6.1	*Aristida purpurascens*	13.7	*Bulbostylis warei*	10.2
Galactia elliottii	10.2	*Sabal etonia*	6.0	*Balduina angustifolia*	12.8	*Panicum spp.*	9.9